PDG Meson Team

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- Meson team members and responsibilities
- Activities toward RPP2004
- Standalone fit for $\psi(2S)$ and $\chi_c(1P)$ branching ratios
- Other problems
- Perspectives

Meson Team Members and responsibilities

Claude Amsler	Zurich	Notes
Michael Doser	CERN	Management, notes
Simon Eidelman	Novosibirsk	Literature, notes
Juan-Jose Hernandez	Valencia	Notes
Alberto Masoni	Cagliari	Notes
Sergio Navas	Granada	Notes
Claudia Patrignani	Genova	Notes
Nils Tornqvist	Helsinki	Notes, theory

All of us “encoders” and “overseers” (LBL terminology) for unstable mesons

Responsibilities

- Each group member is mainly (but not exclusively) responsible for particles with a specific set of quantum numbers - scalars, vectors, etc.
- Papers selected during the literature search (every 2 months) are assigned to a corresponding first reader who writes a summary note in LaTeX specifying what and how should go to the database.
- The first reader sends the note to the second reader (randomly selected, unless there is a good reason to choose a particular person) who adds his criticism and comments. Iterative procedure starts if needed until both readers agree.
- The note approved by two readers goes to the internal database and its ps file is sent to LBL to be entered in the Database.
- The first reader checks the results of the input.
- In specially difficult or problematic cases, the group has dedicated meetings to discuss the subject.

There are two types of papers:

- There is data to quote - usual note written.
- No data to quote - brief note written to keep trace of the paper. May be added to the database as "Other related paper".

Activities toward RPP-2004

- 170 papers selected
- 449 new measurements:

258	unflavored mesons
37	other mesons
23	strange mesons
40	charmed mesons
82	$c\bar{c}$ mesons
9	$b\bar{b}$ mesons

- New interesting particles
  - κ or $K_0^*(800)$,
  - $D_{sJ}^*(2317)$ and $D_{sJ}(2460)$
  - $\eta_c(2S)$
  - $X(3872)$
- Standalone fit for $\psi(2S)$ and $\chi_c(1P)$ branching ratios updated (one more parameter)
- 10 minireviews of which 7 updated

Fitting for $\psi(2S)$ and $\chi_c(1P)$ branching ratios

- Experiments measure product or ratios of branching ratios, often involving more than one particle.
- Values quoted by experiments extracted from measurement using RPP averages $\longrightarrow$ Hidden non trivial correlations
- RPP2002: introduced new fit to experimentally measured quantities: $\longrightarrow$ cross particle fitting non standard procedure, standalone fit.
- When a branching ratio is measured in different product/ratios it might become necessary to include it as new parameter in the fit.
- New measurements of a branching ratio performed by different technique might force to re-enter appropriately in the DB old measurements
  - In 2002 $\mathcal{B}(\chi_{c0} \to \pi\pi)$ was rescaled from $\mathcal{B}(\psi(2S) \to \gamma\,\chi_{c0})\mathcal{B}(\chi_{c0} \to \pi\pi)$.
  - In 2003 new measurement of $\mathcal{B}(\chi_{c0} \to \pi\pi)\mathcal{B}(\chi_{c0} \to p\bar{p})$ forced to include the old and new measurement in the fit, with a new parameter
  - The old entries related to $\mathcal{B}(\chi_{c0} \to \pi\pi)$ measurements had to be re-coded

Problems with standalone fit

- Special care must be taken to avoid errors: two independent fitting programs (Fortran and C, both based on MINUIT) to cross check result (central values, errors, correlations)
- Fit output sent to LBL where it's entered into the Database. Proof-reading, etc.
- As a non standard procedure, it must be done by hand and implies a non negligible workload.
- Minireview describing new fit and providing necessary details (correlation matrix) has also to be updated.
- Cross particle fitting could become needed also in other cases...
  If we had for example measurements of

$$\mathcal{B}(J/\psi \to \eta_c\gamma)\mathcal{B}(\eta_c \to \text{fin}) \quad \mathcal{B}(\psi(2S) \to \eta_c\gamma)\mathcal{B}(\eta_c \to \text{fin})$$

$$\Gamma(\eta_c \to \gamma\gamma)\mathcal{B}(\eta_c \to \text{fin}) \quad \Gamma(\eta_c \to p\bar{p})\mathcal{B}(\eta_c \to \text{fin}) \quad \Gamma(\eta_c \to p\bar{p})\mathcal{B}(\eta_c \to \gamma\gamma)$$

$$\frac{\mathcal{B}(\eta_c \to \gamma\gamma)}{\mathcal{B}(\eta_c \to \text{fin})} \quad \frac{\mathcal{B}(\eta_c \to p\bar{p})}{\mathcal{B}(\eta_c \to \text{fin})} \quad \frac{\mathcal{B}(\eta_c \to p\bar{p})}{\mathcal{B}(\eta_c \to \gamma\gamma)}$$

Other problems

- No data entered directly
- Proofreading incomplete (no ideograms)
- General features of the Database (some properties of the relational database missing, e.g. changing particle names)
- No cross particle fitting even in the simplest cases
- Limited automatic rescaling (only one branching ratio, cannot rescale ratios of branching ratios)
- Current structure of the entries should be expanded to take into account possible new "properties" (definition of mass, coupled channel analysis)

Perspectives

Still very active field

- B-factories are not just for "B physics": already many results (and surprises) on other mesons
- many new papers in last year from BES-II ($c\bar{c}$ and light mesons)
- KLOE (ϕ factory) started publishing
- VEPP-2M closed but still providing results
- CLEO-III (closed) begins publishing on their new $b\bar{b}$ samples
- CLEO-c started to take data and already publishing on $c\bar{c}$
- in 3 years BES-III and VEPP-2000 will begin operations
- on a longer term: experiments at GSI

Extra Slides

Branching ratios and hidden correlations

Most of $Q\bar{Q}$ branching ratios measured from cascade decays thus depend on the radiative decay branching ratio of vector states.

Examples:

$$\mathcal{B}(J/\psi \to \gamma\eta_c)\mathcal{B}(\eta_c \to X) \qquad \text{or} \qquad \mathcal{B}(\psi(2S) \to \gamma\eta_c)\mathcal{B}(\eta_c \to X)$$

Any η_c branching ratio depends on $\mathcal{B}(J/\psi \to \gamma\eta_c)$ and/or $\mathcal{B}(\psi(2S) \to \gamma\eta_c)$.

Even those that do not apparently depend on it

- $\mathcal{B}(\eta_c \to \gamma\gamma)$ derived from E835 measurement of $\mathcal{B}(\eta_c \to \gamma\gamma)\mathcal{B}(\eta_c \to p\bar{p})$
- $\mathcal{B}(\eta_c \to \phi\phi)$ derived by Belle eventually from $\dfrac{\mathcal{B}(\eta_c \to \phi\phi)}{\mathcal{B}(\eta_c \to K\bar{K}\pi)}$

are "hiddenly" correlated to it, because $\mathcal{B}(J/\psi \to \gamma\eta_c)$ enters the determination of $\mathcal{B}(\eta_c \to K\bar{K}\pi)$ and $\mathcal{B}(\eta_c \to p\bar{p})$

Correlation or constraints: an example

The values in the original literature for $\Gamma(\chi_{c2} \to \gamma\gamma)$ derived from direct measurement of $\Gamma_{\gamma\gamma}\mathcal{B}_{J/\psi\gamma}$ or Γ and $\frac{\mathcal{B}_{\gamma\gamma}}{\mathcal{B}_{J/\psi\gamma}}$ at χ_{c2} are hiddenly correlated to $\mathcal{B}(\psi(2S) \to \gamma\chi_{c2})$, since the latter had been used to determine the "external input"

$$\mathcal{B}_{J/\psi\gamma} = \frac{\mathcal{B}(\psi(2S) \to \gamma\chi_{c2})\mathcal{B}(\chi_{c2} \to J/\psi\gamma)}{\mathcal{B}(\psi(2S) \to \gamma\chi_{c2})}$$

However these three measurements would allow to derive

$$\mathcal{B}_{J/\psi\gamma} = \sqrt{\frac{\Gamma_{\gamma\gamma}\mathcal{B}_{J/\psi\gamma}}{\Gamma}\frac{\mathcal{B}_{J/\psi\gamma}}{\mathcal{B}_{\gamma\gamma}}}$$

independently from the the former one. Thus indirectly constraint $\mathcal{B}(\psi(2S) \to \gamma\chi_{c2})$